



TL-Series Toploading Balances

Operation Manual



Declaration Of Conformity

Denver Instrument Company declares that the following products:

TL-Series Balances

conform to the European Union Council Directives and other standards listed below:

73/23/EEC, "Low Voltage Directive"

EN 61010-1, "Safety requirements for electrical equipment for measurement, control, and laboratory use. Part 1. General requirements"

89/336/EEC, "Electromagnetic Compatibility Directive"

EN 55011, Group 1, Class A, "Limits and methods of measurement of radio disturbance characteristics of industrial, scientific, and medical (ISM) radio-frequency equipment"

EN 50082-1, "Electromagnetic compatibility - Generic immunity standard; Part 1: Residential, commercial, and light industry"

Further information may be obtained from the manufacturer, or from the manufacturer's representative:

manufacturer:

Denver Instrument Company
6542 Fig Street
Arvada, CO 80004 USA

manufacturer's representative:

Denver Instrument Company, Ltd.
Denver House
Sovereign Way
Trafalgar Business park
Downham market
Norfolk, UK PE38 9SW

Table Of Contents

Declaration of Conformity	.ii
Introduction	.1
Unpacking Your Balance	.1
Model Specifications	.2
Installation	.3
Setup	.4
Display and Keypad	.6
Software Layout	.8
Calibration	.9
Basic Weighing	.11
Units	.12
Statistics	.15
Environmental	.19
Animal Weighing	.22
Count Mode	.24
Check Weighing	.26
Good Laboratory Practice	.29
Serial	.33
Stored Tare Weights	.39
Batch Weighing	.42
System	.44
Password	.47
Specific Gravity	.48
Factory Settings	.50
Troubleshooting	.52
Setting the Scale	.53
Interface details and Serial Commands	.55
Linearity Procedure	.58
Linearity Weight Settings	.61
Glossary of Terms	.62
Gram Conversion Chart	.63
Menu Tree	.64
External Transformers	.67
Accessories	.67
Cleaning Instructions	.68
Maintenance	.68
Warranty Instructions	.Inside Back Cover

You have purchased a quality precision weighing instrument that requires handling with care.

*Read entire contents of this **Operation Manual** prior to operating your new Denver Instrument balance.*

Disclaimer Notice

“Calibrate your balance using reference weights of the appropriate tolerance (class). An instrument can be no more accurate than the standard to which it has been compared. For assistance in the selection of reference weights, please contact the factory”.

Class A Digital Devices:

Notice: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. The equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this device in a residential area is likely to cause harmful interference in which the user will be required to correct the interference at his own expense.

Caution: Changes or modifications not expressly approved by the manufacturer could void the user’s authority to operate this equipment.

Manufactured in the U.S.A. by:

 **Denver Instrument Company**

6542 Fig Street • Arvada, Colorado 80004
(303) 431-7255 • (800) 321-1135 • Fax(303) 423-4831

Introduction

Thank you for selecting a precision Denver Instrument Company balance. Your balance is designed and engineered to provide years of reliable performance.



WARNING

Use of this product in a manner not specified by the manufacturer may impair any safety protection provided by the equipment!

UNPACKING YOUR BALANCE

Carefully remove your balance from the packing material. The weigh pan assembly and power transformer are removed from the balance for shipping but are in the same box.

Be sure that you have received each of the following items with your balance:

- Balance
- Operation Manual
- Warranty Registration Card
- Weigh Pan Assembly:
Round pan and ring (for 3.5" or 4.5" pans)
or square pan)
- Power Transformer

Carefully read this operation manual in order to take full advantage of the many features of your balance. Be sure to read the section on the proper care and maintenance of your balance so that it will provide you with years of reliable service.

Please complete and return your warranty registration card, so that in the event your balance is lost or stolen, Denver Instrument Company will have a record of your balance's serial number. Also take a moment right now to record the model and serial number of your balance on the inside back cover of this manual for future reference.

Model Specifications

Analytical Models

Model	64	104	204
Weighing Range	61g	110g	210g
Readability	0.1mg	0.1mg	0.1mg
Linearity	0.2mg	0.2mg	0.2mg
Repeatability, (s)	0.1mg	0.1mg	0.1mg
Stabilization Time	4 sec	4 sec	4 sec
Pan Dimensions	3.5" (9cm)	3.5" (9cm)	3.5" (9cm)

Toploading Models

Model	203	403	402	602
Weighing Range	210g	410g	410g	610g
Readability	0.001g	0.001g	0.01g	0.01g
Linearity	0.002g	0.003g	0.01g	0.01g
Repeatability, (s)	0.001g	0.001g	0.01g	0.01g
Stabilization Time	3 sec	3 sec	2 sec	2 sec
Pan Dimensions	4.5" (11cm)	4.5" (11cm)	6.0" (15cm)	6.0" (15cm)

Model	2102	4102	2101	4101	6101
Weighing Range	2100g	4100g	2100g	4100g	6100g
Readability	0.01g	0.01g	0.1g	0.1g	0.1g
Linearity	0.01g	0.02g	0.1g	0.1g	0.1g
Repeatability, (s)	0.01g	0.01g	0.1g	0.1g	0.1g
Stabilization Time	2 sec	2 sec	2 sec	2 sec	2 sec
Pan Dimensions	8.375x8.375" (21x21cm)	6.0" (15cm)	8.375x8.375" (21x21cm)	8.375x8.375" (21x21cm)	8.375x8.375" (21x21cm)

Model	8101	12001	603D	4102D	8102D
Weighing Range	8100g	12000g	610/110g	4100/410g	8100/810g
Readability	0.1g	0.1g	0.01/0.001g	0.1/0.01g	0.1/0.01g
Linearity	0.2g	0.2g	0.01/0.002g	0.1/0.01g	0.2/0.01g
Repeatability, (s)	0.1g	0.1g	0.01/0.001g	0.1/0.01g	0.1/0.01g
Stabilization Time	2 sec	2 sec	2 sec	2 sec	2 sec
Pan Dimensions	8.375x8.375" (21x21cm)	8.375x8.375" (21x21cm)	4.5" (11cm)	8.375x8.375" (21x21cm)	8.375x8.375" (21x21cm)

Common Specifications

Electrical Requirements:	15VDC @ 800 mA with AC Adapter, center pin (+)
Controls:	Silicone rubber keypad, Zero, Display ON/OFF, and 3 softkeys
Display:	4.5 x 1.75 inch (12.3 x 4 cm) custom LCD with backlight
Interface:	RS-232 Bidirectional
	16 weighing units and 2 custom
	Calibration with external weight (minimum of 4 permissible)
	Custom calibration with external weight and weigh value entry
	Count mode (Average Piece Weight or Piece Counting)
	Environmental settings
	Animal weighing mode
	Specific gravity mode
	Check weighing mode (Low and High Limits or Percent to Target)
	Statistics function (number, min., max., range, average, standard deviation and total)
	250 last weight storage with edit capability
	Stored tare weights (10)
	User custom setup (10)
	Password security
	Date, time and weigh value of last calibration
	Batch weigh with printout of Tare weight, Net weight and Gross weight
	Custom printout with selection of date/time, sample type, sequence number, balance ID, signature line, and operator.
	Height above pan (analyticals): 9.5" (24cm)
Net Weight:	8.7 lbs. (3.9 kg) Round Pan 10 lbs. (4.5kg) Square Pan 14.6 lbs. (6.6 kg) Analytical
Shipping Weight:	12.0 lbs. (5.4 kg) Round Pan 13.0 lbs. (5.9 kg) Square Pan 17.8 lbs. (8.0 kg) Analytical

Installation

Preparation

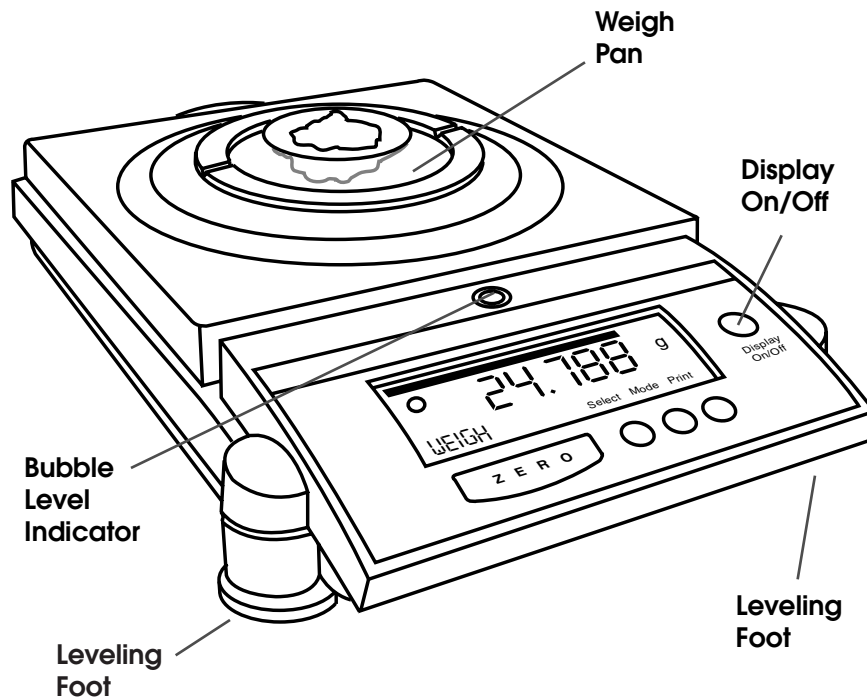
This product is intended for indoor use.

Select a level, rigid work area that is free from drafts and vibrations (i.e. away from doors, windows, air conditioning and heating vents).

The line voltage to the balance should be reasonably constant (+/-10%) and free from fluctuations.

Position balance to allow the removal of the power adapter plug from the wall outlet. It is not advisable to use an outlet that is shared with fluorescent fixtures or other electrical equipment that draws current in an inconsistent manner.

Do not locate the balance near magnetic materials, or near instruments that incorporate magnets in their design. Avoid areas that experience extreme highs, lows or fluctuations in room temperature. Excessive temperatures that may affect balance operation and accuracy are 1) above 105°F (40°C) and 2) below 60°F (15°C).



Setup

Carefully remove the balance and all accessories from the carton. There are no tie-downs; however there may be packing materials under the pan support (square-pan models only).

LEVELING THE BALANCE

1. The leveling feet are located on the bottom of the balance. Do not turn the balance over. Viewing the balance from above, turn all leveling feet counterclockwise until the feet are fully retracted into the balance base.
2. Note the position of the bubble on the leveling vial. For maximum weighing accuracy, the bubble should be located inside the black ring. Some adjustment will likely be necessary.
3. Begin with the foot that is opposite of the location of the bubble and turn clockwise until the bubble is moved into the black ring. If necessary, repeat this step with the other leveling feet until the bubble is positioned in the center of the black ring.
4. Avoid extending the level feet too far. If it seems necessary to do so, it is likely that the tabletop is not level. Check the surface on which you have placed the balance; it may be necessary to choose another location.



The bubble moves TOWARD a foot when that foot is turned CLOCKWISE. The bubble moves AWAY from a foot when that foot is turned COUNTERCLOCKWISE.

POWERING THE BALANCE



WARNING

Verify that you have received the proper voltage power supply for your country of use!

Insert the power cord into the receptacle located at the back of the balance and plug the power adapter into a wall outlet. The display will perform a quick test in which all segments are briefly illuminated and display "stabilizing" for 30 seconds.

INITIAL WARM-UP PERIOD

After the initial power-up, it is necessary to allow a minimum of 60 minutes for the balance components to become warm and for the internal temperature to stabilize.

It is not necessary to unplug your balance from the power source when it is not in use. It is advised to leave the unit plugged in so that all components are warm and the balance is ready to weigh at any time. If you wish, the display can be turned off to save the segment life, by simply pressing the Display On/Off button.

WEIGH PAN INSTALLATION



WARNING

Mishandling the balance weigh pans can cause serious mechanical damage!

The balance weigh pan engages critical and delicate mechanical components inside the balance. Please observe the following precautions when handling the weigh pans:

1. Do not apply manual pressure to the weigh pan at any time.
2. Do not bump the pan.
3. Do not drop objects onto the pan.
4. Do not attempt to clean or vigorously wipe the pan while it is installed on the balance.

ROUND-PAN MODELS

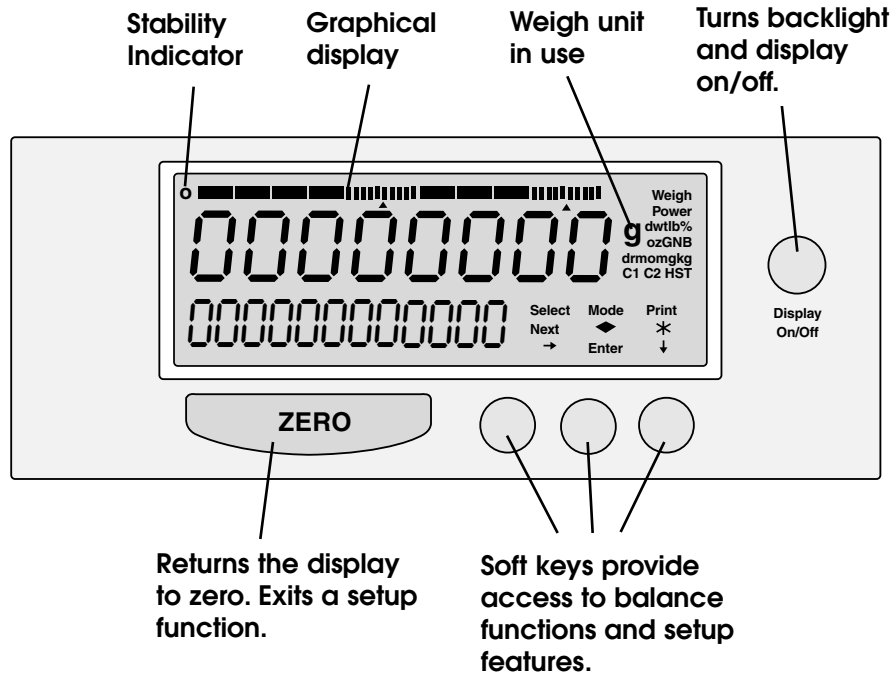
Balances with 3.5" or 4.5" round pans feature a weigh pan assembly that consists of an aluminum pan and an impact protection ring that helps to shield the weigh pan from lateral shocks. (For models with 6" pans, simply place pan on pan stem.)

1. Place the impact ring on the balance first.
2. Center the weigh pan over the impact ring and gently slide or twist (do not push) the pan onto the pan stem.
3. When removing the pan for cleaning, remove the impact ring first and then pull the weigh pan straight up and off (pulling the pan at an angle could result in mechanical breakage).

SQUARE-PAN MODELS

Simply place the square top-pan on the pan support. You're ready to begin weighing!

Display and Keypad



The balance features an integrated display/keypad. The high-contrast LCD display simultaneously provides alpha and numeric information for ease in setup and accuracy in interpretation of results.

DISPLAY

Stability Indicator. This icon is illuminated when the balance has stabilized, indicating that the displayed weight is your final result.

Weigh Units. The current selected weigh unit is displayed. The balance will keep two weigh units resident for ready use at all times. Press "Select" to toggle between the two resident weigh units. (Factory default is grams.) See page 12 for a complete list of weigh units, their display abbreviations and how to change the current weigh units.

Functions. The functions align with the soft keys on the keypad to provide access to the balance's many setup features.

Graphical Display. Bar graph indicates remaining capacity of balance.

KEYPAD

Zero key. Pressing the zero key returns the weight display to a zero reading. This is especially useful for taring (subtracting) container weights.

Soft keys. Three soft keys align with the displayed functions to provide easy access to all balance setup features. See "Soft Key Operation"

Display On/Off key. Press once to turn backlight off, press twice to turn the display only off to save segment life. Pressing it again turns the display and backlight back on.

SOFT KEY OPERATION

Your balance contains a broad range of features that allow you to customize the unit to your specific weighing application(s). Navigating through the options is easy using the "soft key" (software programmable key) operation.

Each soft key on the keypad aligns with a balance function on the display. To select a function, press the key that is just below it.

To exit any selection in the menu, press the ZERO key and the balance will return to the weigh screen.

DYNAMIC FINE RANGE (603D, 4102D AND 8102D Models)

This feature allows the user access to the fine weighing range at any point along the entire weighing spectrum. Simply press the "Zero" key to rezero the balance and the fine weighing range is accessed.

Software Layout

The balance has a wide variety of modes of operation and set up parameters for different weighing applications. Parameters can easily be changed by scrolling through the options and choosing the desired selection. The different weighing modes include: basic weighing, animal weighing, statistics, counting, check weighing and specific gravity calculating. The default mode is basic weighing. When a mode is turned ON, the mode name will appear in the lower left corner of the display.

Basic weighing = WEIGH	Counting = PCS (for pieces)
Animal weighing = ANIMAL	Check Weighing = UNDER, OK or OVER
Batch Weighing = Prompts	Specific gravity = SPC GRAVITY (and prompts)
Statistics = SAMPLES	



Modes must be turned Off to return to basic weighing or entering a new mode will turn the previous mode Off.

Setup parameters for optimizing the balance for your specific needs and conditions include: weighing unit, environmental settings, serial interface settings and Good Laboratory Practice custom printout information.

Other administration functions can also be accessed including setting password protection, setting users with different parameters or checking system conditions (ie software version).

All selection of modes and changes to parameters are made by pressing the Mode softkey and then using the Next softkey to scroll through the available options. When the desired selection is shown, press the Enter softkey.



On entering a setup function with multiple selections (ie baud rate), the first selection will be the current setting.

The following shows the order of the available routines by screen name, however a complete listing of all selections is the the Menu Tree on page 64 of the manual.

<u>Screen Name</u>	<u>Function</u>
CALIBRATE	Calibration
UNITS	Weighing unit selection
STATS	Statistics mode
ENVIRO	Environmental settings
ANIMAL	Animal weighing mode
COUNT	Counting mode
CHECK WEIGH	Check weighing mode
GLP	GLP printout and reporting information
SERIAL	Serial interface settings
TARE WEIGHTS	Tare weight recall and setup
BATCH	Batch weighing mode
SYSTEM	Check system status
PASSWORD	Security protection setup
SPC GRAVITY	Specific Gravity mode
FACTORY	Return to factory default settings

Calibration

Your balance was calibrated at the factory; however, it is necessary to re-calibrate upon setup and on a regular basis thereafter. The factory recommendation for calibration is once per week using the maximum permissible weight standard. Reasons for more frequent calibration include 1) moving the balance, 2) organizational procedures, 3) special samples/applications which require documented calibration time/date stamp.

Your balance may be calibrated in the External mode or the Manual mode. Both use an external mass standard. In the external mode the balance will recognize the calibration weight as one of the permissible weight values, whereas in the Manual mode an exact certified value of the calibration weight is entered.

PERMISSIBLE WEIGHTS

Model	Weight																		
	20	30	50	60	100	200	300	400	500	600	800	1000	2000	4000	5000	6000	8000	12000	
64	X	X	X	X															
104	X	X	X	X	X														
204			X	X	X	X													
203			X	X	X	X													
403					X	X	X	X											
402					X	X	X	X											
602					X	X	X	X	X	X									
2102								X	X	X			X	X					
4102										X		X	X	X					
2101								X	X	X		X	X						
4101										X		X	X	X					
6101													X	X	X	X	X		
8101													X	X	X	X	X	X	
12001													X	X	X	X	X	X	X
603D				X	X	X	X	X	X	X									
4102D								X	X	X		X	X	X					
8102D											X	X	X	X	X	X	X	X	

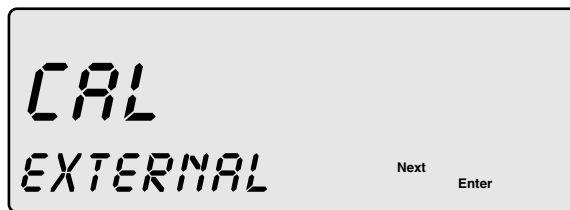
EXTERNAL CALIBRATION (using a mass standard)

Be certain that the balance has stabilized.

1. Select "Mode".
2. Press "Enter".



3. Press "Enter" .



4. Place mass standard on the weighing pan (see Permissible Weights Chart). The balance recognizes the mass and automatically calibrates.



NOTE! Do not remove weight until screen returns to weigh screen.

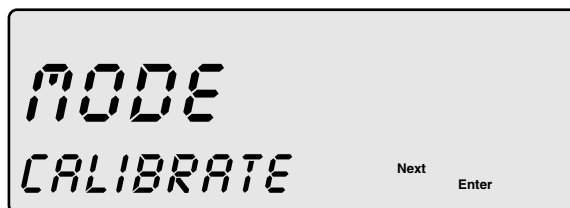
5. Once calibrated, the balance will return to the weigh display.

MANUAL CALIBRATION (using a mass standard)

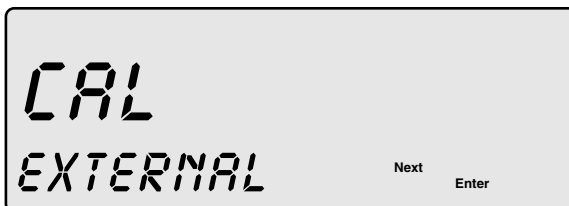
IMPORTANT!!

The decimal point is after the 5th digit. BE CAREFUL to enter numbers in the proper spaces when manually calibrating. For instance, to calibrate 200 grams, press the "right" arrow twice and then enter "2", then press the "Enter" button. To calibrate 2000 grams, press the "right" arrow once, enter "2", then press the "Enter" button. If this is done incorrectly, you must go to "Setting Scale", and perform that procedure before continuing.

1. Select "Mode".



2. Press "Enter".



3. Press "Next".



4. Press "Enter".

5. Enter the desired mass standard value using the arrow keys and press "Enter".



6. At Add Weight prompt, place the mass standard on the weighing pan.

7. When stable, Press "Enter".

8. Once calibrated, the balance will return to the weigh display.

Basic Weighing

You are ready to begin weighing if you have:

- Set up the balance in an acceptable location (see page 3)
- Calibrate the balance (see page 9)

For optimum accuracy, please place your samples as near the center of the weighing pan as possible.

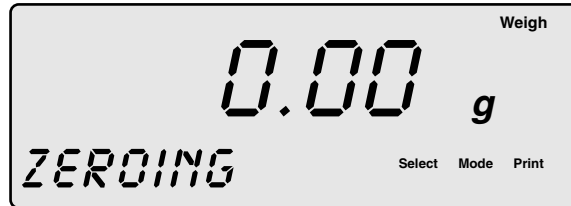
Your balance is designed to provide accurate measurements regardless of where you place the sample on the pan; however, repeatability, accuracy and stabilization time are optimized if the load is placed as close to the center of the pan as possible.

Press the ZERO key to access the weighing mode (the word WEIGH will appear in both the upper right-hand corner and the lower left-hand corner.

TARING

To subtract the weight of the sample container:

1. Place the empty container on the weighing pan.



2. Press ZERO.

3. Add sample to the container and wait for the stability icon to appear (upper left-hand corner).

4. The weight of the sample only will appear on the display.

Stability icon



Units

Your balance offers 16 different weigh units and 2 user-customizable units. Weigh units available (display symbol): Grams (g), Kilograms (kg), Milligrams (mg), Ounces (oz), Troy Ounces (ozt), Pounds (lb), Grains (gn), Pennyweight (dwt), Carats (c), Tael HK, Hong Kong (H), Tael Sing, Singapore (S), Tael Taiwan (T), Momme (mom), Dram (dr), Baht (B), Tola (t), and two custom, user-defined (C1 and C2).

Selecting Weigh Units

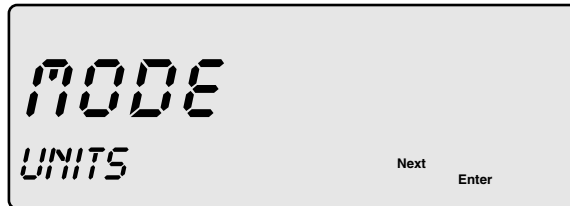
Your balance will keep two weigh units resident for ready use at all times. To toggle between the two weigh units, press the soft key "Select" which appears on the main weighing screen.

The factory default weigh unit is grams. To change the selected weigh units:

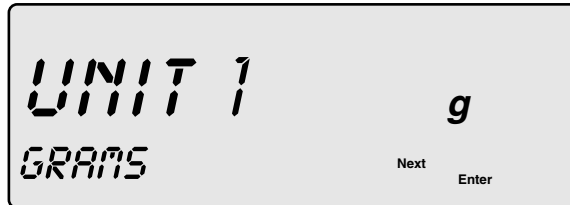
1. Select "Mode".



2. Press "Next".



3. Press "Enter".



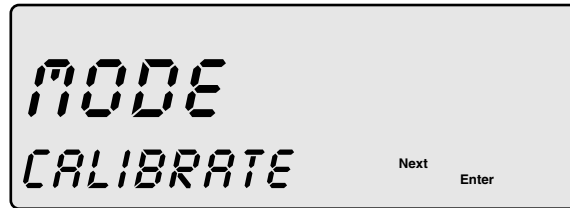
4. To scroll through the weigh units, continue to press "Next".
5. To choose a weigh unit, simply press "Enter"
6. Weigh Unit 1 will be stored into memory. Repeat steps 4 and 5 above to select Unit 2
7. To return to the weigh mode, press ZERO.
8. Press "Select" to toggle between the two weigh units. An icon will appear to the right of the weight display indicating which weigh unit is in use.

Custom Weigh Units

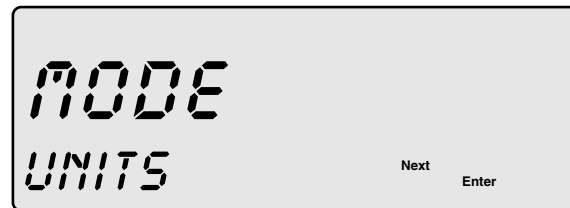
To have the balance automatically perform a multiplication of the weight value (g) or to set a Custom unit, simply enter the appropriate factor into one of two Custom units. These can also be set as Unit 1 and Unit 2 for immediate access.

To enter a Custom unit:

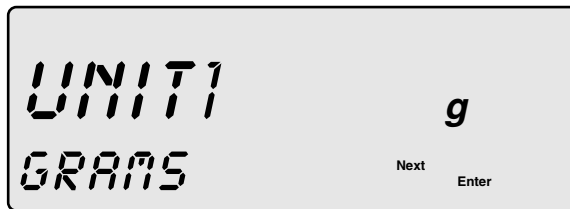
1. Select "Mode".



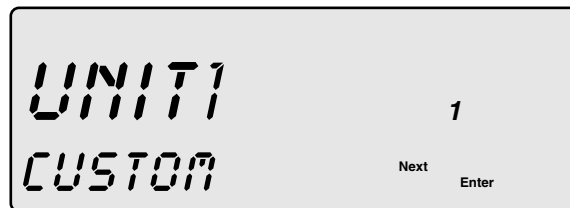
2. Press "Next".



3. Press "Enter".



4. Scroll through the weight units, with the "Next" key until CUSTOM is displayed.



5. Press "Enter".



- 6. Enter the desired factor using the arrow keys.
- 7. To save the factor entry press "Enter".
- 8. Select UNIT2 or press ZERO to return to the weigh screen.

Statistics

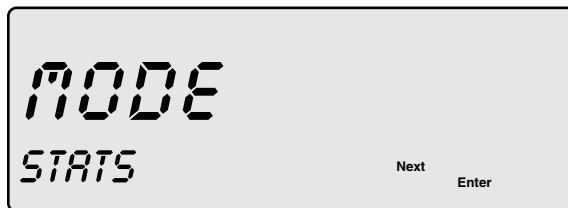
Your balance has an internal memory of 250 weighings which can be used to store, list, select, output or to perform statistical evaluation of selected weighing. To begin storing weights to memory statistics must first be turned ON.

To turn statistics ON.

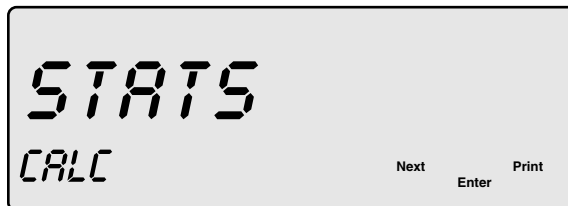
1. Press "Mode".



2. Press "Next" until MODE, STATS.



3. Press "Enter".



4. Press "Enter".
The display will return to the weigh screen with SAMPLES 0 in the lower left corner. After weighings have been stored, SAMPLES X will show the number stored.



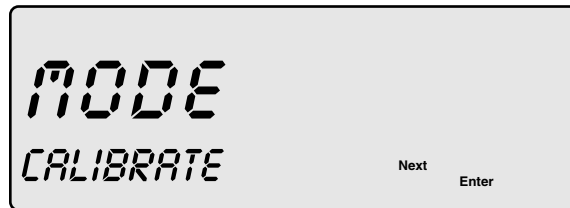
To rapidly return to the Stats setup, press Select from the weigh screen in the Statistics mode.

To store a weight to memory

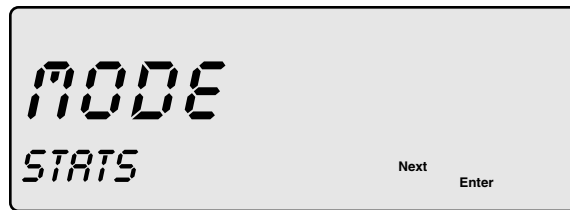
1. With the weight on the pan, press "Print". The SAMPLES will increase by one showing that the weight has been added to memory.
2. Continue to add more weights to memory.

To list stored weights

1. Press "Mode".

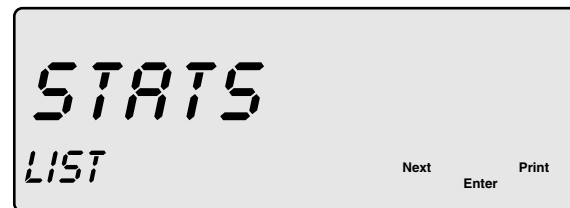


2. Press "Next" until MODE, STATS

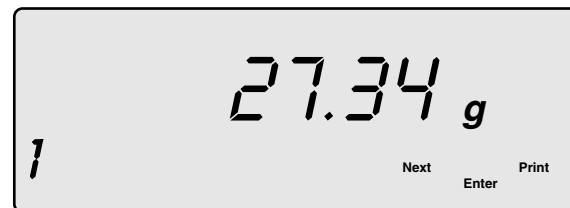


3. Press "Enter".

4. Press "Next" until STATS, LIST.



5. Press "Enter" to show first stored weight.

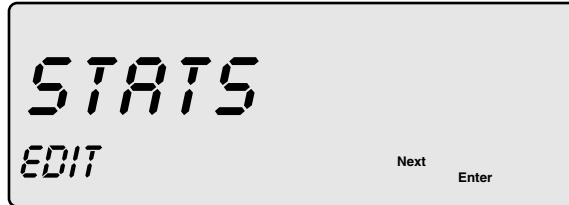


6. Press "Next" repeatedly to scroll through all stored weights

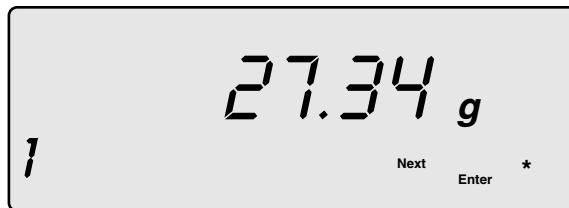
7. Press "Enter" to exit to STATS.

To edit stored weights

1. From STATS, EDIT press "Enter" to show the first stored weight.



2. Press "Next" repeatedly to scroll through all stored weights.



3. Press the * to remove a weight.

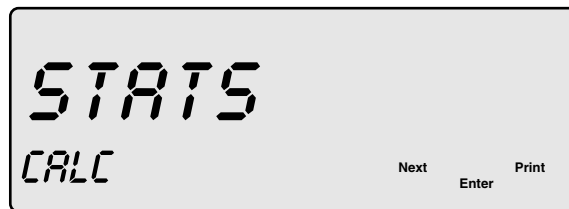


Removing a weight does not delete it from memory, but only removes it from being used in the statistics function.

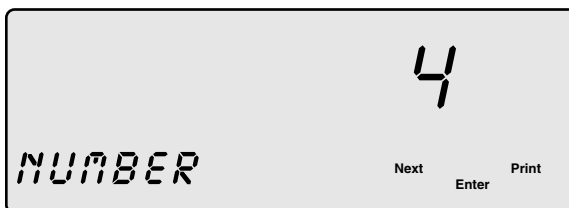
4. Continuing to press "Next" will display only the desired weights
5. Press "Enter" to exit to STATS.

To calculate statistics including Number, Minimum Weight, Maximum Weight, Range, Average, Standard Deviation and Total Weight

1. From STATS, CALC press "Enter".



2. Press "Next" to scroll through each statistical calculation.



3. Press "Enter" to exit to STATS.

To print all calculations

1. From STATS, CALC press "Print".

To print any one calculation

1. From STATS, CALC press "Enter".
2. Press "Next" to scroll through each statistical calculation.
3. Press "Print" on desired screen to print that calculation.

To output or print all data through the serial port

1. From STATS, LIST press "Print".
2. Press "Enter" to exit to STATS.

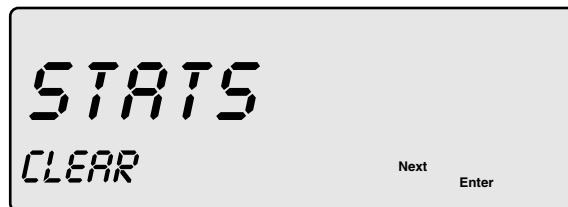
To print or output select data

1. From STAT, LIST press "Enter".
2. Press "Next" to select data.
3. Press "Print" to print this data only.
4. Press "Enter" to exit to STATS.

Statistics Printout
STATS NUM = 5 Min = 300.02 MAX = 300.03 RNG = 0.01 AVE = 300.025 STD = 0.004 TOT = 1500.11

To clear or delete all weights from memory

1. From STATS, CLEAR press "Enter".



2. AT YES, press "Enter" to confirm and exit to STATS. Otherwise press "Next" for NO and then "Enter" to exit without clearing.



To turn statistics OFF

1. From the weigh screen press "Select".
2. At STATS, TURN OFF press "Enter" and return to the weigh screen.

Or

- 1) From STATS press "Next" until STATS, TURN OFF.
- 2) Press "Enter" and return to the weigh screen.

Environmental

Your balance can be set up for optimized weighing to compensate for varying conditions including building vibration, drafts, surface vibration, etc. The Environmental settings consist of four subsettings including Filter, Stability Speed, Stability Sensitivity and Autozero. Each has multiple selections.

Environmental Settings

<u>Filter</u>	<u>Stability Speed (sec)</u>	<u>Stability Sensitivity (counts)</u>
Very Low	Very Slow 4	Very Fine .25
Low	Slow 2	Fine .5
Normal	Normal 1	Normal 1
High	Fast .5	Coarse 2
Very High	Very Fast .25	Very Coarse 4

Examples

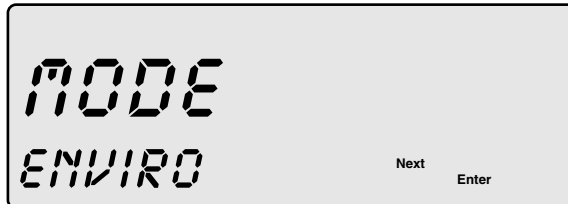
	<u>Filter</u>	<u>Stability Speed</u>	<u>Stability Sensitivity</u>
Good weighing	Normal	Normal	Normal
Filling	Low	Fast	Fine
Low vibration	High	Slow	Coarse
High vibration or Breeze	Very High	Very Slow	Very Coarse

To change the Environmental settings:

1. Select "Mode".



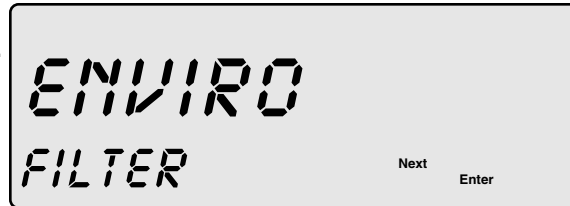
2. Press "Next" until MODE, ENVIRO.



3. Press "Enter".

To change Filter

1. From ENVIRO, FILTER press "Enter".



2. Press "Next" to scroll through the 5 selections (very low, low, normal, high, very high)



3. Press "Enter" to select and return to ENVIRO, ST SPEED.

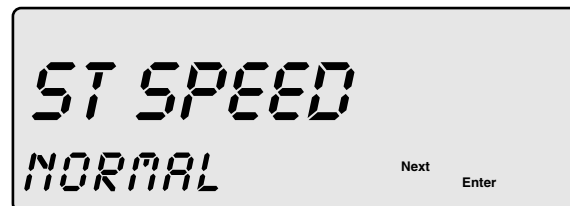
To change Stability Speed

1. From ENVIRO, STABIL SPEED press "Enter".



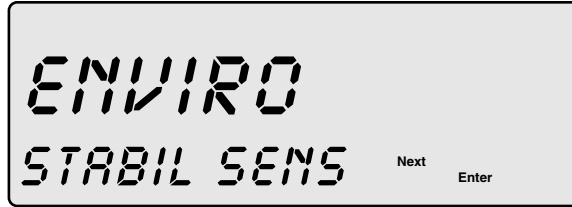
2. Press "Next" to scroll through the 5 selections (very slow, slow, normal, fast, very fast).

3. Press "Enter" to select and return to ENVIRO.

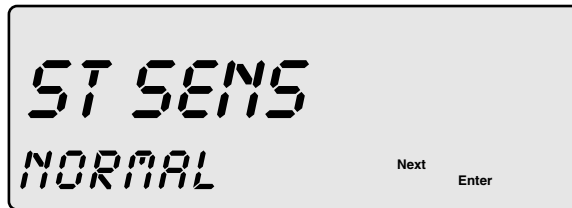


To change Stability Sensitivity

1. From ENVIRO, STABIL SENS press "Enter".



2. Press "Next" to scroll through the 5 selections (very coarse, coarse, normal, fine, very fine)



3. Press "Enter" to select and return to ENVIRO.

To change Autozero

1. From ENVIRO, AUTOZERO press "Enter".



2. Press "Next" to scroll through the 4 selections.

3. Press "Enter" to select and return to ENVIRO.



Animal Weighing Mode

Your balance is featured with an animal weighing mode to easily weigh animals which are continuously moving as a weight is taken. This mode must first be turned ON. The weigh screen will show Animal in the lower left corner when the animal weighing mode is ON. Animal weighing settings include: Stability Speed and Stability Sensitivity.

Animal Weighing Settings

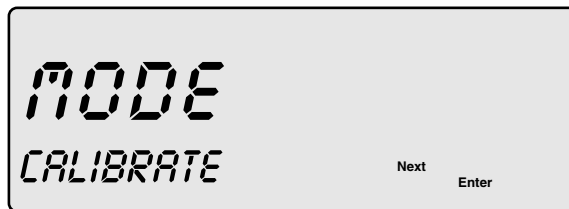
Stability Speed	(seconds)	Stability Sensitivity	(counts)
Slow	8	Very Fine	4
Normal	4	Fine	8
Fast	2	Normal	16
		Coarse	32
		Very Coarse	64

Changing the stability speed will vary the integration time. Changing the stability sensitivity is needed to filter the effect of the moving animal. If the lock does not come on, decrease the sensitivity by going to a coarser setting.

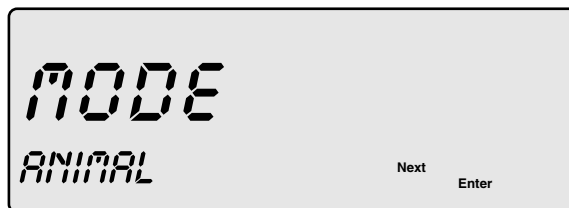
During weighing when the stability criteria is met the weight will lock on the display. When the weight is removed the display will unlock and be ready for the next sample.

To turn Animal mode ON

1. Select "Mode".



2. Press "Next" until MODE, ANIMAL.



3. Press "Enter" for
TURN ON.

4. Press "Enter".

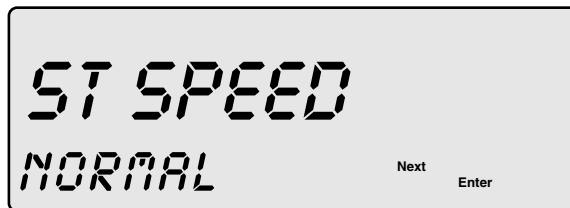


To change Stability Speed

1. From ANIMAL,
STABIL SPEED press
"Enter".

2. Press "Next" to
scroll through the
3 selections.

3. Press "Enter" to
select and return
to ANIMAL.

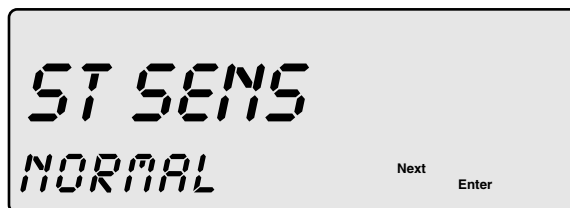


To change Stability Sensitivity

1. From ANIMAL,
STABIL SENS
press "Enter".

2. Press "Next" to
scroll through the
5 selections.

3. Press "Enter" to
select and return
to ANIMAL.



**To rapidly return to the Animal set up, press Select from
the Animal Weigh screen.**

To turn OFF animal weighing mode

1. From ANIMAL, TURN OFF press "Enter" and return
to the weigh display.

Count Mode

The balance can be set to count common pieces that are within the capacity and resolution of the balance. Please note that counting accuracy will be affected by weight variation among pieces. Select parts which are appropriate to the resolution of the balance:

- **The total sample weight must not exceed the balance capacity**
- **The weight of each piece must be greater than the resolution of the balance.**

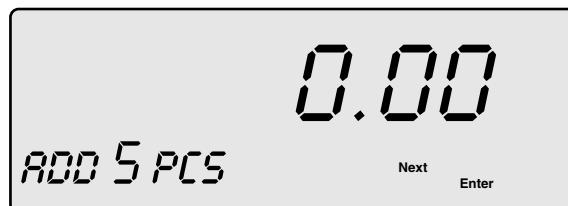
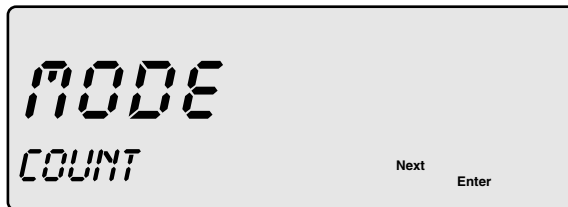
See "Specifications" inside the front cover for the capacity and resolution of your particular balance.

Your balance may count in the Piece Count or Average Piece Weight modes.

To perform Piece Counting

Piece Count allows the operator to perform basic counting of identical items. This operation is carried out by first weighing a known number of items (5, 10, 20, 50 or 100), as follows:

1. Select "Mode".
2. Press "Next" until MODE.COUNT.
3. Press "Enter".
4. Press "Enter".
5. Count out 5 pieces and place them on the weighing pan.
6. Press "Enter". The balance will store the per-piece value and return to the weigh display with the precise total in the lower left corner. To count additional pieces, simply add them to the weighing pan.



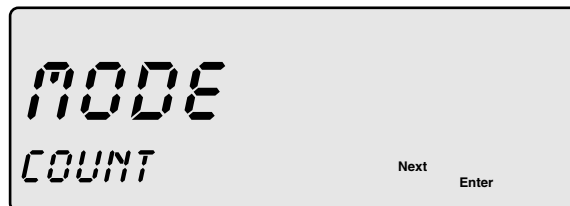
To Perform Average Piece Weight

Average piece weight allows the operator to determine the number of individual pieces in a mass if the per piece weight is known.

1. Select "Mode".



2. Press "Next" until
MODE COUNT.



3. Press "Enter".



4. Press "Next".



5. Press "Enter".

6. Enter the known
average piece
weight using the
arrow keys and
press "Enter".



The balance returns to the count display
with the precise total in the lower left corner.



The Select softkey in the count mode will return to the count set up. To count additional pieces, simply add them to the weighing pan.

To turn the Count mode off.

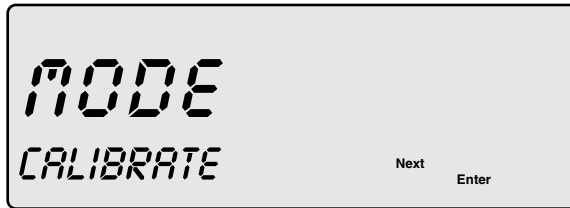
1. Press "Select".
2. Press "Next" until TURN OFF and press "Enter".

Check Weighing

Your balance has two check weighing modes. Low and High Limits and Percent to Target. In Low and High Limits, the display will show the words "UNDER" if the sample is under the low limit, "OVER" if the sample weight is over the high limit or "OK" if the weight is between the limits. There is also a visual indication in the bar graph. In the Percent to Target, a target weight is entered and the samples weight is expressed as percent of the target weight.

To set Low and High Limits

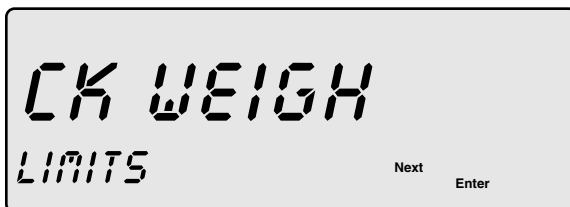
1. Select "Mode".



2. Press "Next" until MODE, CHECK WEIGH.



3. Press "Enter".



4. Press "Enter".

5. Enter the low limit value using the arrow keys

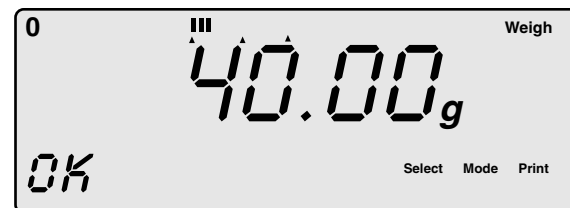


6. Press "Enter".

7. Enter the high limit value using the arrow keys



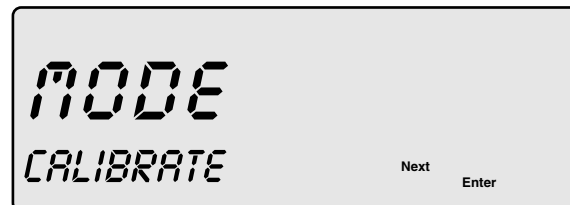
8. Press "Enter" and return to the weigh screen in the Check Weighing mode.



Note To rapidly return to the Check Weighing set up, press Select from the weigh screen in the Check Weighing mode.

To set Percent to Target

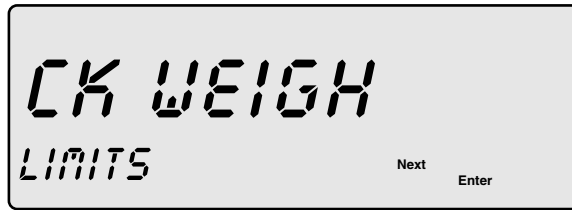
1. Select "Mode".



2. Press "Next" until CHECK WEIGH.



3. Press "Enter".



4. Press "Next".

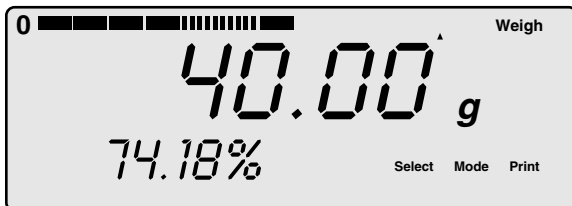


5. Press "Enter".

6. Enter the target weight using the arrow keys.



7. Press "Enter" and return to the weigh screen in the Percent to Target mode.



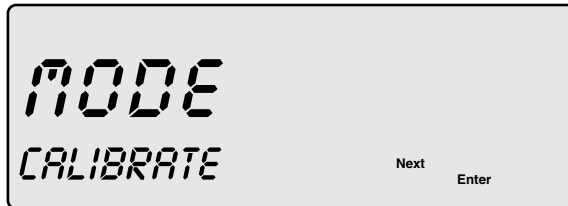
To rapidly return to the Check Weighing set up, press Select from the Check Weighing screen.

Good Laboratory Practice

Your balance has a number of features which will allow customization for various reporting requirements pertaining to Good Laboratory Practice documentation of results. In GLP set up the parameters of date and time, user, sample type and sequence number are entered. With the interface of an optional printer or computer via the serial communications port, these parameters may be selected to be included on a printout along with the weight. The selection of which parameters to include on the printout is done in the Serial setup when the Custom Printout format is chosen. In GLP setup each of nine users with alphanumeric names may also have unique setup parameters including weighing mode (standard weighing, counting, check weighing or animal weighing), printout format including different custom printouts, sample type and weighing units. Once users are set up, simply recalling a user automatically changes the parameters for that user, if different parameters were set.

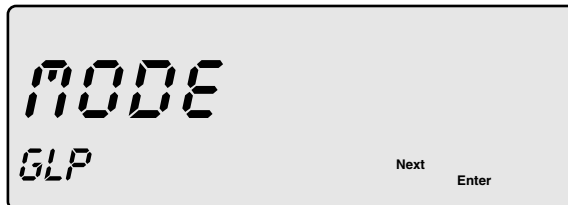
To save User specific parameters

1. Make desired parameter changes.

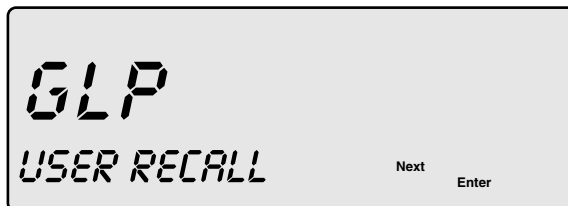


2. Select "Mode".

3. Press "Next" until MODE, GLP.



4. Press "Enter".



5. Press "Next" until
GLP,USER SAVE.



6. Press "Enter".

7. Press "Next" to
select a User 1-9,
then press "Enter".



8. Enter the desired
user name using
the arrow keys up
to 12 characters.



9. Press "Enter" to
save name.

To recall a user

1. From GLP, USER
RECALL press
"Enter".



2. Press "Next" to
scroll through the
list of users.

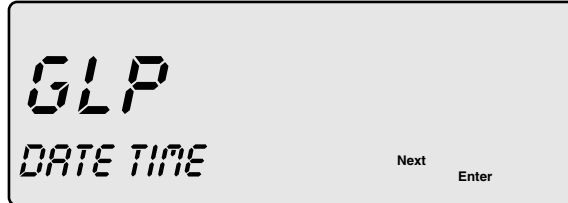


3. Press "Enter" at
the desired user
and exit to the
Weigh screen.



To set date and time

1. From GLP, DATE TIME press "Enter".

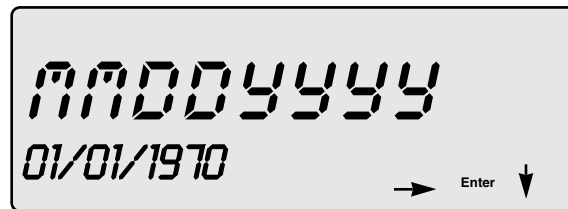


2. Press "Next" until format of Month, Day, Year (MM DD YYYY) or Day, Month, DATE TIME, MMDDYYYY.



3. Press "Enter".

4. Enter the date using the arrow keys and press "Enter".



To set time

1. From GLP, 24-HR CLOCK press "Enter".

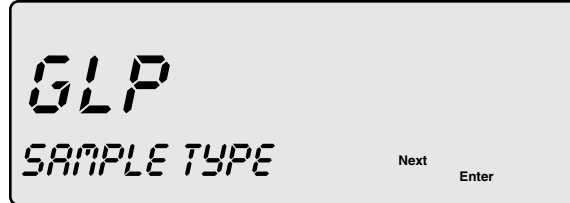


2. Enter the time in 24 hour format of hour, minutes and seconds using the arrow keys and press "Enter".

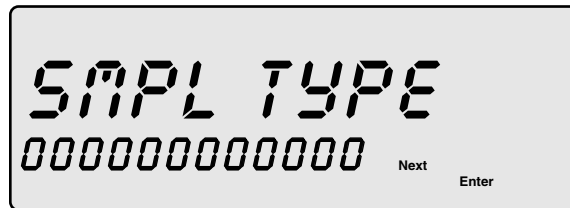


To set sample type

1. From GLP, SAMPLE TYPE press "Enter".

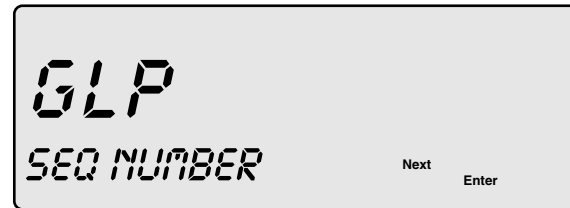


2. Enter the desired name using the arrow keys up to 12 characters and press "Enter".



To set a sequence number

1. From GLP, SEQ NUMBER press "Enter".



2. Enter the desired starting number using the arrow keys and press "Enter".
(Maximum 9999)



The sequence number will advance by 1 on each successive printout.

Serial

The balance has a serial port which enables communications with other serial devices such a printer or computer. The Interface Applications section of this manual will assist in selecting the proper set up parameters. Serial set up parameters include: print mode, print format including custom printout, baud rate, parity, bit, echo and handshake. The following are instructions to change set up parameters.

Print mode:

Manual - serial port only outputs weight data when the Print key is pressed and the balance is stable.

Stable - serial port outputs weight data automatically when stable

Interval - serial port output at the set time interval

SAMPLE OUTPUT CHART

Actual output may vary decimal places depending on model.

Output can be in one of the following formats:

Analytical Balances

Type	Stable	Unstable
Type 1	1 +100.0001 1 + 0.0001	U +100.0001 U + 0.0001
Type 2	S +100.0002 S + 0.0002	SD +100.0002 SD + 0.0002
Type 3	ST +100.0001 ST + 0.0001	US +100.0003 US + 0.0003
Type 4	+ 100.0003 + 0.0003	+ 100.0002 + 0.0002
Type 5	+100.0002 GRAMS + 0.0002 GRAMS	+100.0002 US + 0.0002 US
Type 6	+100.0002 GRAMS + 0.0002 GRAMS	+100.0001 GRAMS + 0.0001 GRAMS
Type 7	1 + 100.0002 GRAMS 1 + 0.0002 GRAMS	U + 100.0003 GRAMS U + 0.0003 GRAMS
Type 8	S 100.0002 g S 0.0002 g	SD 100.0002 g S 0.0002 g
Type 9	1+0100.0002 1+0000.0002	U+0100.0002 U+0000.0002

SAMPLE OUTPUT CHART

Actual output may vary decimal places depending on model.

Output can be in one of the following formats:

Toploading Balances

Type	Stable	Unstable
Type 1	1 +100.002	U +100.002
	1 +100.003	U +100.003
Type 2	S +100.001	SD +100.001
	S + 0.002	SD + 0.002
Type 3	ST +100.003	US +100.003
	ST + 0.001	US + 0.003
Type 4	+ 100.003	+ 100.001
	+ 0.0001	+ 0.0001
Type 5	+100.002 GRAMS	+100.003 US
	+ 0.002 GRAMS	+ 0.003 US
Type 6	+100.001 GRAMS	+100.002 GRAMS
	+ 0.001 GRAMS	+ 0.002 GRAMS
Type 7	1 + 100.003 GRAMS	U + 100.001 GRAMS
	1 + 0.003 GRAMS	U + 0.001 GRAMS
Type 8	S 100.002 g	SD 100.003 g
	S 0.003 g	S 0.003 g
Type 9	1+0100.001	U+0100.002
	1+0000.001	U+0000.002

Baud rates: 38,400 1,200
 19,200 600
 9,600 300
 4,800 150
 2,400

Bits/Parity: 8 - none
 7 - even
 7 - odd
 7 - none

Echo: Off, On
 Handshake: XON/XOFF, None

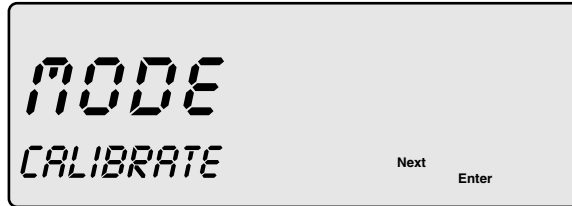
The serial port pin configuration:



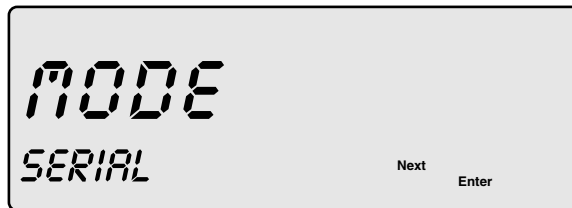
1 GND 3 OUT
 2 IN 4 GND

To change print mode

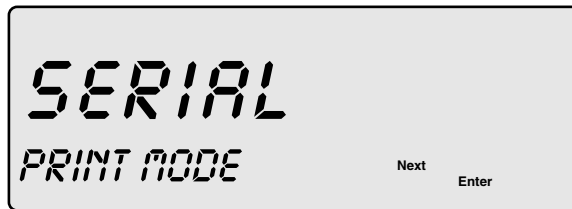
1) Select "Mode".



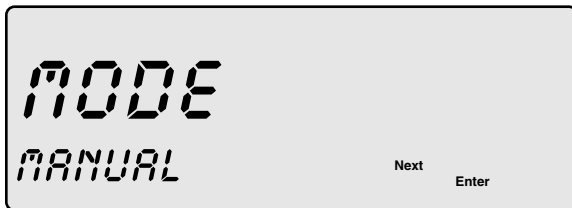
2) Press "Next" until
MODE, SERIAL.



3) Press "Enter".



4) Press "Enter".



5) Press "Next" to
scroll through
selections and
press Enter. A
selection of 5, 10
or 60 seconds is
standard or a
custom number
up to 9999 may be entered.



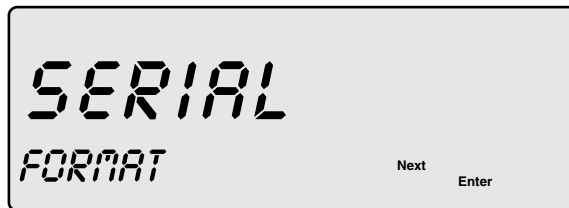
To change format

Nine selections of the format are preset for simple weight documentation or communications to a computer. To customize the printout in addition to the weight the following items can be individually added:

- Date and time*
- Balance ID
- Sample type*
- Sequence number*
- Calibration information
- Operator name*
- Signature lines (2)

* Specific setup of these items is done in GLP setup

1. From SERIAL, FORMAT press "Enter".



2. Press "Next" to scroll through selections (Type 1-9 and CUSTOM PRINT).



3. Press "Enter".

To set up Custom Print

1. From FORMAT, CUSTOM PRINT press "Enter".



2. Press "Enter" to scroll through available items.

3. Press "Enter" to toggle ON or OFF as desired.

4. Press "*" key to SERIAL, BAUD.



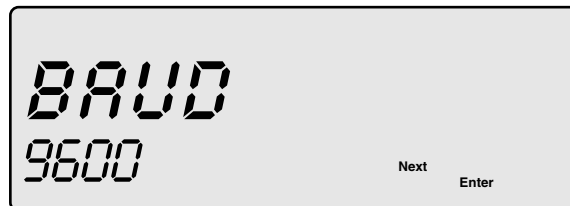
If using custom printout, the interval print cannot be set faster than the time to print the custom printout.

To change Baud Rate:

1. From SERIAL, BAUD press "Enter".



2. Press "Next" to scroll through selections (150-19200) and press "Enter".

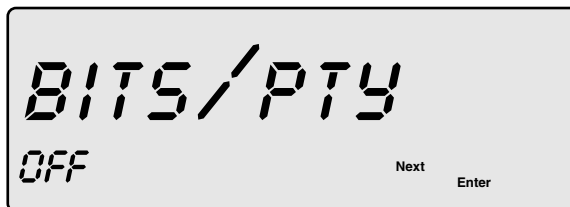


To change Bits/Parity:

1. From SERIAL, PARITY press "Enter".



2. Press "Next" to scroll through selections (8-none, 7-even, 7-odd and 7-none) and press "Enter".



To change Echo:

1. From SERIAL, ECHO press "Enter".

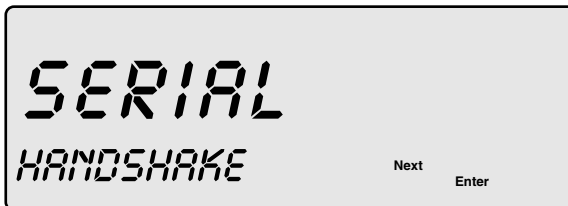


2. Press "Next" to scroll through selections (Off and On) and press "Enter".

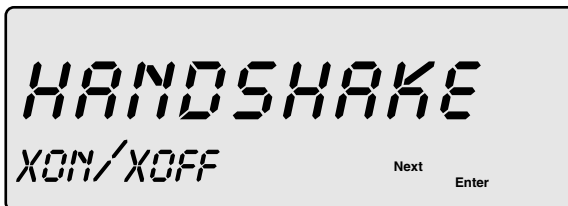


To change Handshake:

1. From SERIAL, HANDSHAKE press "Enter".



2. Press "Next" to scroll through selections (XON and XOFF) and press "Enter".

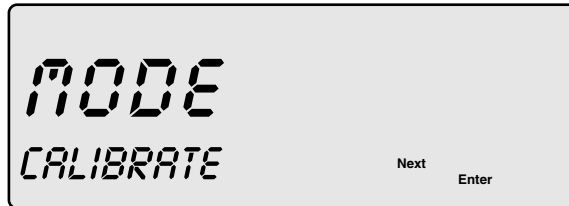


Stored Tare Weights

The balance features the capability to store ten tare weights to memory for easy recall of weighing objects held in containers. Tare weights can be entered automatically by weighing the container or manually entering the weight of the container.

To store tare weights automatically

1. Select "Mode".



2. Press "Next" until MODE, TARE WEIGHTS.



3. Press "Enter".

4. Press "Next" until TARE WT, STORE-AUTO.



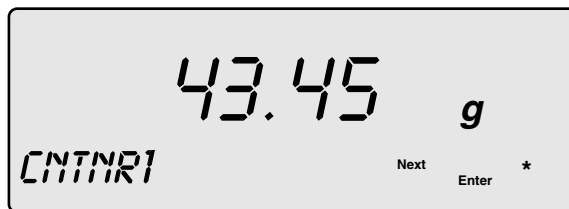
5. Press "Enter" to show CNTNR 1.

6. Place container on pan and when stable press "Enter".



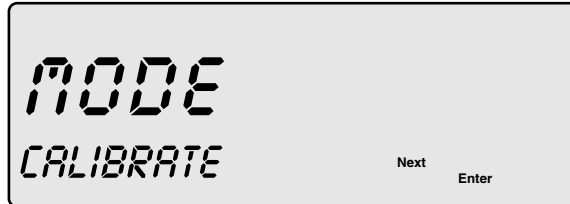
7. Repeat steps 5 and 6 to store additional container weights

8. Press "*" to exit to TARE WT.



To store tare weights manually

1. Select "Mode".



2. Press "Next" until MODE, TARE WEIGHTS.

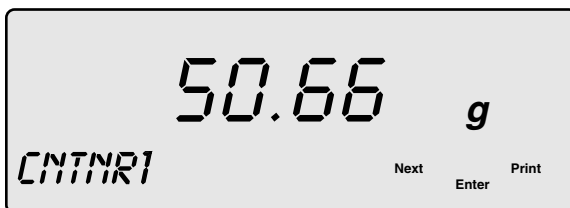


3. Press "Enter".

4. Press "Next" until TARE WT, STORE-MANUAL.



5. Press "Enter" to show CNTNR 1.



6. Press "Next" until available CNTNRV and (showing no weight) press "Enter".

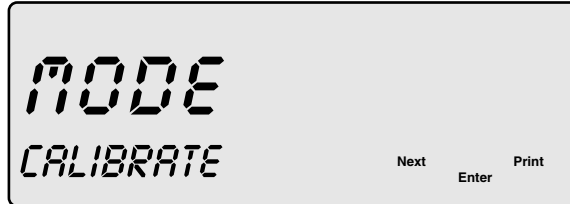


7. Enter container weight using arrow keys and then press Enter

8. Repeat steps 5 and 6 to store additional container weights

To select a stored tare weight after storing

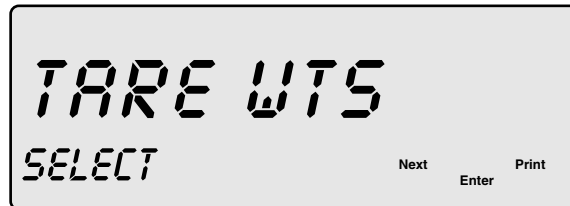
1. Select "Mode".



2. Press "Next" until
MODE, TARE
WEIGHTS.



3. Press "Enter" for
select.



4. Press "Enter".

5. Press "Next" to
scroll through to
desired container.



6. Press "Enter" to
return to the weigh
screen with a negative
weight of the container.



**Unless a tare weight has been entered, it will show
NONE on entry.**

To print stored tare weights

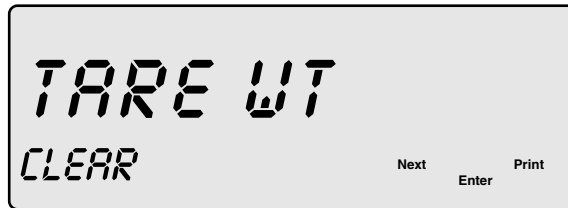
1. From TARE WT, press "Print".

To clear stored tare weights

1. From MODE, TARE WEIGHT press "Enter".



2. Press "Next" until TARE WT, CLEAR.



3. Press "Enter" for CLEAR ALL.



4. Press "Enter" to clear all stored tare weights or press "Next" to scroll through stored container weights to select just one to clear and press "Enter".

5. Press "Enter" to clear.

Batch Weighing

The Batch Weighing mode is a sequence of weighing steps with screen prompts and a specific printout including Tare Weight, Net Weight and Gross Weight.

To turn batch weighing ON

1. Select "Mode".



2. Press "Next" until
BATCH MODE.



3. Press "Enter".

4. Press "Enter" to
return to the weigh
screen in Batch
mode.



To perform batch weighing

1. Remove weight from the pan and press the ZERO key to zero the balance.
2. At the ADD TARE WT prompt, add the weighing container.
3. Press "Enter" when stable.
4. At the ADD NET WT prompt, add the sample to be weighed.
5. Press "Enter" when stable.
6. At the PRINT prompt, press the "Print" key. After printing the display will return to the ADD TARE WT prompt to begin the sequence again.



For additional information on the printout, see Custom printout setup.

To turn batch weighing OFF

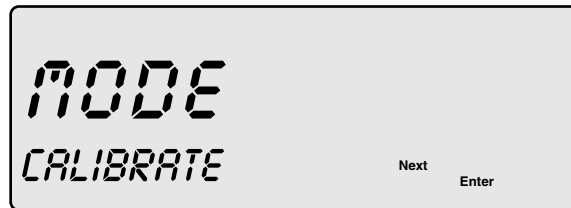
1. From weigh display press "Select".
2. From BATCH TURN OFF, press "Enter" to return to the weigh display.

System

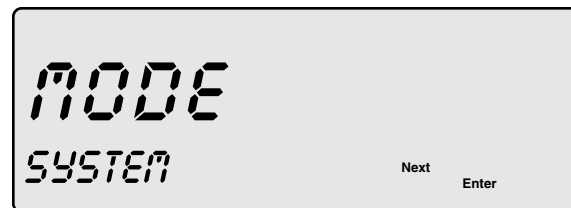
The balance features options to identify the specific unit, and its software version or date and time of last calibration. This screen also gives access to secured options intended for super users including a routine to adjust linearity. For access to the secured routines call your local distributor or Denver Instrument Company.

To check software version

1. Select "Mode".



2. Press "Next" until MODE, SYSTEM.



3. Press "Enter" to show SYSTEM, SW VERSION.

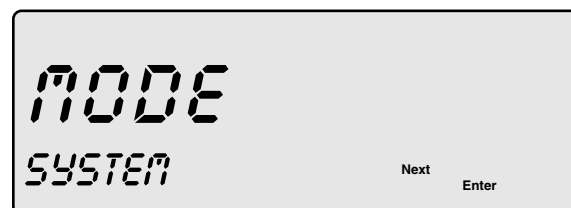


4. Press "Enter" to show SW VERS, XXX.



To check balance ID

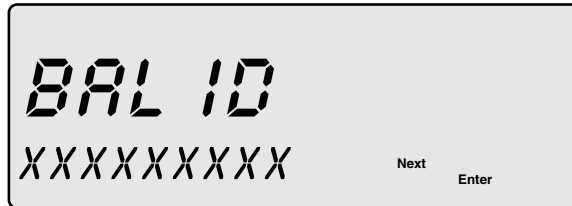
1. From MODE, SYSTEM, press "Enter".



2. Press "Next" until SYSTEM, BALANCE ID.

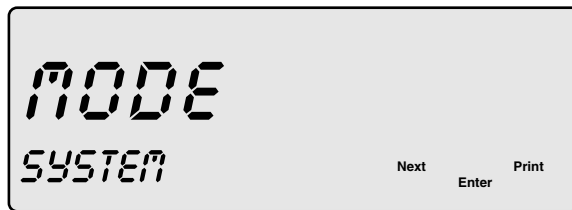


3. Press "Enter" to show BAL ID, XXXXXXXXXX (This is the balance serial number).

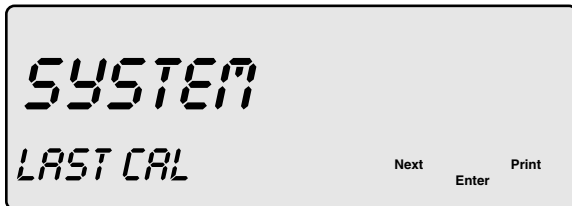


To display date and time of last calibration

1. From MODE, SYSTEM, press "Enter".



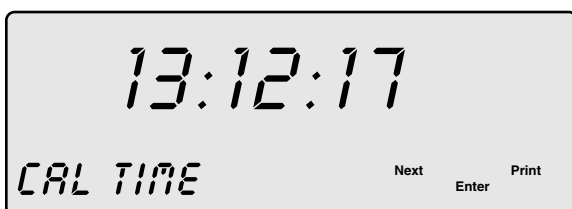
2. Press "Next" until SYSTEM, LAST CAL.



3. Press "Enter" to show date of last calibration.



4. Press "Next" to show time of last calibration.



5. Press "Next" to show calibration weight value.

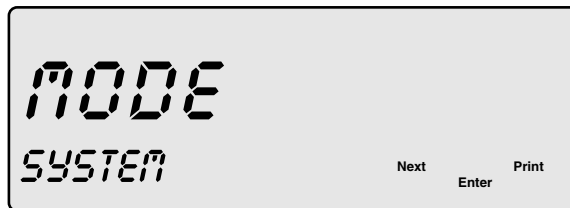


To print calibration data

1. From SYSTEM, LAST CAL press "Print".

To enter security routines

1. From MODE, SYSTEM press "Enter".



2. Press "Next" until SYSTEM, SECURITY.



3. Press "Enter" for super user access.

4. Enter the security password using the arrow keys and press "Enter".

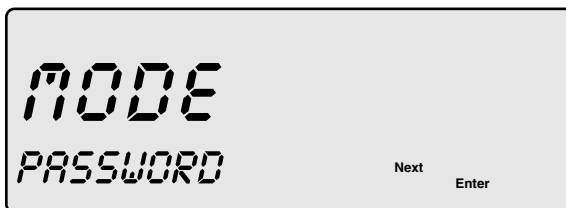


Password

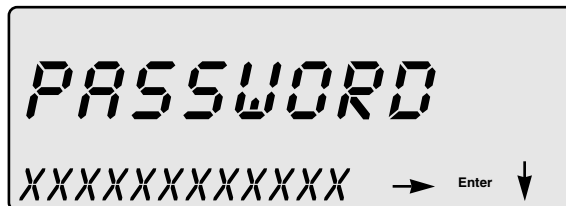
The balance can be protected from being able to make setup parameter changes including from being able to calibrate the balance.

To password protect the balance

1. From MODE, PASSWORD press "Enter".



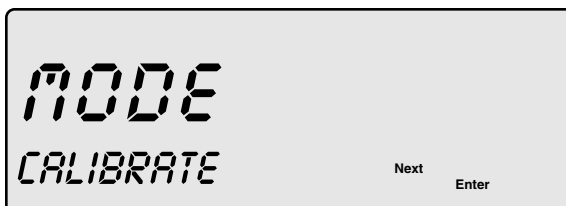
2. Enter the desired password up to 12 characters using the arrow keys.



3. Press "Enter" to return to the Weigh screen. You will no longer be able to enter balance setup with the Mode key without reentering the correct password.

To remove the password protection

1. Select Mode from the Weigh screen to display PASSWORD, XXXXXXXXXXXX.



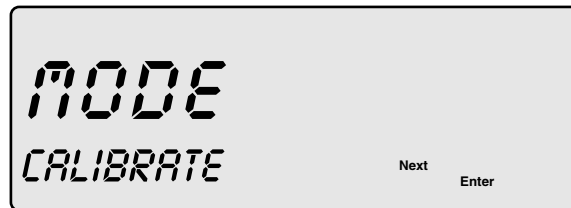
2. Enter the correct password.

Specific Gravity

The balance includes the automatic calculation of specific gravity from two weighings (weigh above and weigh below). Both may be new weights or either of the previous weights may be used.

To calculate specific gravity

1. Select "Mode".



2. Press "Next" until MODE, SPC GRAVITY.



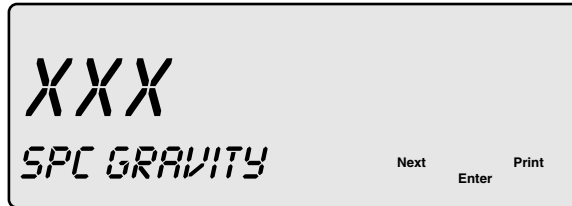
3. Press "Enter".

4. The Zero key may be used to zero the balance before adding weight.



5. Press "Enter" to accept the weigh above value.

6. Perform the weigh below step. Press "Enter" to accept the weigh below value and to display specific gravity calculation.

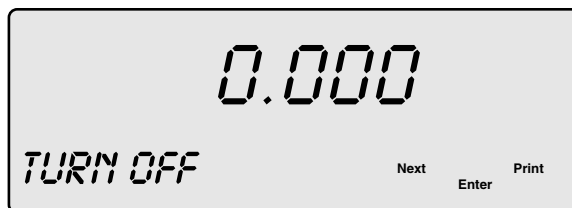


To turn specific gravity Off

1. From MODE, SPC GRAVITY press "Enter".



2. Press "Next" until TURN OFF and press "Enter".



Or

1. From SPC GRAVITY calculation display, press "Next" for TURN OFF.

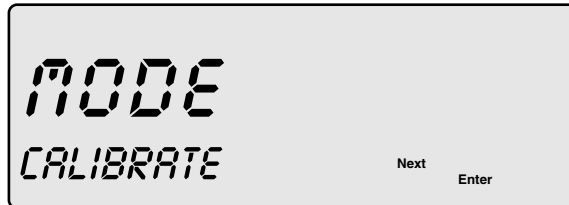
2. Press "Enter" to return to weigh display.

Factory Settings

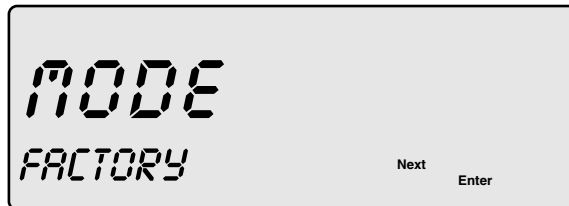
The balance comes preset with factory default settings. At some time you may want to reset the balance to factory settings.

To reset to factory default settings

1. Select "Mode".



2. Press "Next" until
MODE, FACTORY.



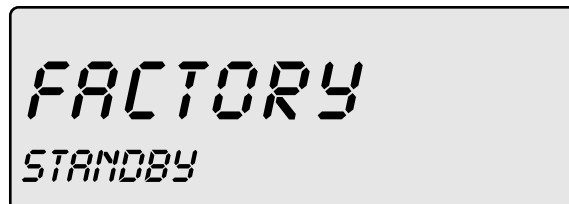
3. Press "Enter".



4. Press "Next".



5. Press "Enter".
Displayed momentarily
(15 seconds).





6. From complete press "Enter" to return to the Weigh screen.



List of Factory Defaults

Units1	grams
Unit2	grams
Statistics	Off
Count mode	Off
Check weighing	Off
Date and time	01/01/1970
Sequence No	(empty)
Sample Type	(empty)
Tare weights	none
Filter	Normal
Stability speed	Normal
Stability sensitivity	Normal
Auto-Zero	Normal
Serial print mode	Manual
Serial format	Type 1
Serial baud	9600
Serial bits/parity	8-none
Serial echo	Off
Serial handshake	XOn
Animal weighing	Off
Specific gravity	Off
Password	disabled
Batch mode	Off

Troubleshooting

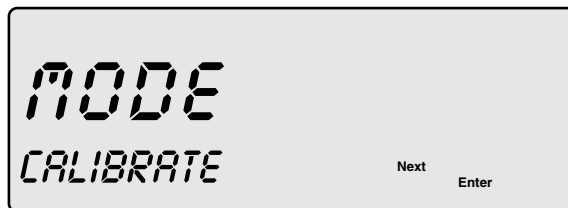
Display Shows	Cause	Remedy
 (Blank Screen)	Power cord not connected.	Connect cord.
	No power to outlet or improper voltage.	Check power supply and voltage switch.
	Temporary fault	Disconnect and reconnect power cord. (Wait at least five seconds before reconnecting it.)
	Bad connection in connecting cord.	Make sure connectors are securely clipped into sockets, disconnect and reconnect cord.
	Weight exceeds balance capacity.	Reduce weight.
Unstable (Stability indicator does not appear and erratic weight display)	Air movement around balance.	Use draft shield and/or change environmental setting.
	Unstable location.	Move balance and/or alter filter setting.
	Sample not stationary.	Use animal weighing mode.
Incorrect weight reading.	Balance operating error.	Re-calibrate balance. Check level.
	Incorrect weigh unit.	Check weigh unit setting.
	Pan obstructed.	Check pan placement. Check optional in use cover.
Display is too dark or too light.	Contrast needs to be adjusted.	Contact Customer Service.

Setting the Scale

The scale may need to be set due to mechanic rebuild, electronic failure, or *incorrect manual calibration*. A calibrated weight to the nearest 10, 100, or 1000 of the maximum capacity of the balance MUST be used. For example, a TL 204 will need a 200g, a TL 8101 will need an 8000g.

1. Remove any weight on the balance and press the "Zero" key to re-zero the balance

2. Press "Mode" key.
Display reads
"MODE....CALIBRATE".

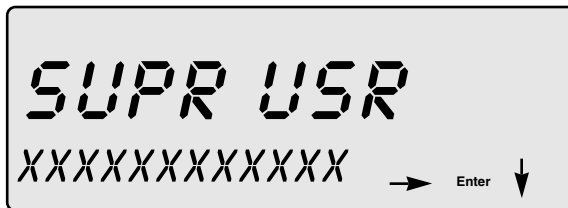


3. Press "Next" key
until "SYSTEM"
appears, then press
"Enter".



4. Press "Next" key
until "SECURITY"
appears, then press
"Enter".

(NOTE! If you have previously been in the security mode, and have not unplugged the balance, the next steps, 6-10 will be unnecessary.)



5. "SUPR USR" appears, as well as some asterisks, the first of which will be flashing.

6. Press the 'down' arrow key to advance the first asterisk to "S".

7. Press the 'right' arrow key to move to the next digit.

8. Press 'down' arrow key to advance the second asterisk to "C".

9. Press the 'right' arrow key to move to the next digit.

10. Press 'down' arrow key to advance the third asterisk to "L".

11. Press "Enter".
"MAINT....SCALE"
appears.



12. Press "Enter".
"SCALE....REMOVE
WTS" appears.



13. Press "Enter".
"STABILIZ" will appear
and a countdown
will occur, and then
"ZERO CAL" will dis-
play, and another
countdown will
occur. The display will
then read "SCALE....
ADD FULL WGT".



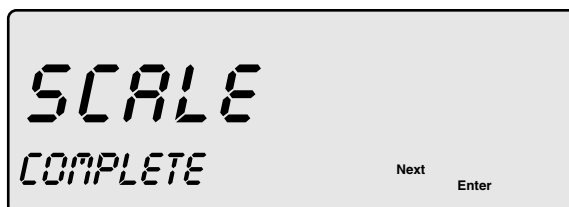
14. Place the maxi-
mum weight,
according to model,
on the pan, and
press "Enter". You will
see the "STABILIZ",
and "FULL CAL", and
countdowns again.
Then the display will
read "SCALE...
REMOVE WTS".



15. Remove the
weight, and press
"Enter". You will see
"STABILIZ", count-
down, and then
"OFFSET" and count-
down. The display will
then read "SCALE....
COMPLETE".



16. Press "Zero" to
return to weigh
mode.



17. Calibrate the bal-
ance according to
operating instruction
manual to verify that
scale was set correctly.

18. To reset Security, unplug balance, and plug back in.

Interface Details and Serial Commands

Serial Commands	Command
SET KEYWORD PARAMETER	
GET KEYWORD	
DO KEYWORD	
"•" Decimal point	
0 - 9 Numeric entry	
AS Set and Get Autozero sensitivity Parameters for set are one of:	OFF NORMAL STRONG VERY STRONG
AU Set and Get alternative units (UNITS2), Parameters for set are one of:	GRAMS KG MG MOMME OZA OZT LB DRAM CARAT GRAIN HTAEL STAEL TTAEL PENNYWEIGHT TOLA BAHT CUSTOM1 CUSTOM2
BL Set and Get current backlight state Parameters for Set are one of:	ON OFF
CA Get last calibration information	
CC Set and Get current container Parameter for Set is a container number between 0 and 10, 0 = no container	
CL Check-low	
CS Cal schedule	
CN Get Statistics sample count	
CW Get current container weight	
DD Set and Get current date in DD/MM/YYYY Parameter for Set is current date in the format DD/MM/YYYY	
CE Do external calibration procedure	
CU Set and get current units to Primary (UNITS1) or Alternate (UNITS2) Parameters for Set are one of:	PRI ALT
DS Set and Get current display state Parameters for Set are one of:	ON OFF
FL Set and Get current environmental filter length Parameters for Set are one of:	VERY_LOW LOW NORMAL HIGH VERY_HIGH
HC Set and Get current check weight high limit Parameter for Set is weight in current units	
LC Set and Get current check weight low limit weight Parameter for Set is weight in current units	

Serial Commands

Command

MM	Set and Get current date in MM/DD/YYYY format Parameter for Set is current date in the format MM/DD/YYYY	
OI	Set and Get current operator index Parameter for Set is operator index between 1 and 10	
ON	Set and Get current operator name Parameter	
PA	Set and Get current piece count average weight Parameter for Set is average weight	
PF	Set and Get current print format Parameters for Set are one of:	FORMAT_1 FORMAT_2 FORMAT_3 FORMAT_4 FORMAT_5 FORMAT_6 FORMAT_7 FORMAT_8 FORMAT_9 CUSTOM
PI	Set and Get current print interval Parameters for Set are interval in seconds	
PM	Set and Get current print mode Parameters for Set are one of:	MANUAL STABLE INTERVAL
PR	Do print current weight data	
PS	Set current password Parameter for Set is password string	
PT	Submit password for testing Use SET PT with password for parameter string	
PU	Set and Get Primary units (UNITS1) Parameters for Set are one of:	GRAMS KG MG MOMME OZA OZT LB DRAM CARAT GRAIN HTAEL STAEL TTAEL PENNYWEIGHT TOLA BAHT CUSTOM1 CUSTOM2
SI	Set and Get sample type Parameter for Set is sample type character string	
SB	Set and Get current serial port baud rate Parameters for Set are one of:	38400 19200 9600 4800 2400 1200 600 300 150

Serial Commands

		Command
SD	Get sample data.	
SE	Set and Get current serial port echo settings Parameters are Set for one of:	ON OFF
SH	Set and Get current Serial Port Handshake settings Parameters are Set for one of:	NONE XON CTS
SL	Set and Get current serial port parity setting Parameters for Set are one of:	8-none 7-OFF 7-ODD 7-EVEN
SN	Set and Get sequence number Parameter for Set is integer sequence number	
SP	Set and Get current stability speed Parameters for Set are one of:	VERY_FAST FAST NORMAL SLOW VERY_SLOW
SS	Set and Get current stability sensitivity Parameters for Set are one of:	VERY_COARSE COARSE NORMAL FINE VERY_FINE
SV	Get Software Version	
T		Zero (tare)
TC	Set and Get current Target Weight settings Parameters to Set is weight in current units	
TT	Set and Get Time in 24 hour mode settings Parameters for Set are as follows:	HH/MM/SS
U1	Set and Get current value for custom 1 units Parameter for Set is multiplier conversion factor	
U2	Set and Get current value for custom 2 units Parameter for Set is multiplier conversion factor	
Z	Zero (tare)	
WM	Set and Get current weigh mode Parameters for Set are one of:	NORMAL COLLECT_STATS CHECK_TARGET CHECK_LIMITS

Linearity Procedure

(Version 3.10 and Later)

Class 1, calibrated weights MUST be used to set linearity. See attached chart for acceptable weight values for each model.

1. Remove any weight on the balance and press the "Zero" key to re-zero the balance.

2. Press "Mode" key.
Display reads "MODE... CALIBRATE".



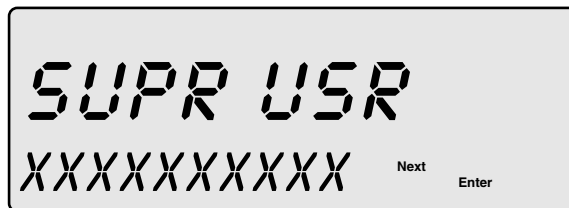
3. Press "Next" key until "SYSTEM" appears, then press "Enter".



4. Press "Next" key until "SECURITY" appears, then press "Enter".

(**NOTE!** If you have previously been in the security mode, and have not unplugged the balance, the next steps, 6-10 will be unnecessary.)

5. "SUPR USR" appears, as well as some asterisks, the first of which will be flashing.



6. Press the 'down' arrow key to advance the first asterisk to "L".

7. Press the 'right' arrow key to move to the next digit.

8. Press the 'down' arrow key to advance the second asterisk to "I".

9. Press the 'right' arrow key to move to the next digit.

10. Press the 'down' arrow key to advance the third asterisk to "N".

11. Press "Enter".
"MAINT....SCALE"
appears.



12. Press "Select"
key until "LINEARITY"
appears.



13. Press "Enter".
"CALC LIN....GET A
POINT" appears.



14. Press "Select"
until "CLEAR DATA"
appears.

15. Press "Enter".
"CALC LIN....COM-
PUTE" appears.

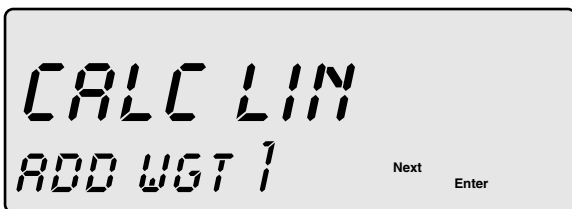


16. Press "Select"
until "GET A POINT"
appears.

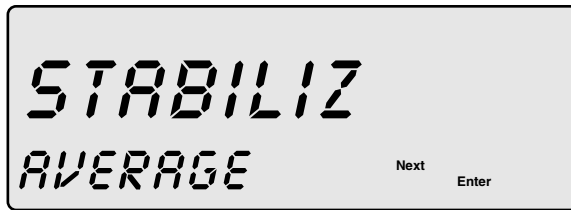


17. Press "Enter".
"ADD WGT 1"
appears.

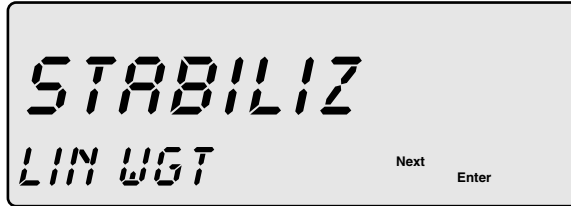
18. Place 1st weight,
according to
attached chart for
the model, on the
pan.



19. Press "Enter". Unit will display "STABILIZ", counting down, and then "AVERAGE", counting down, then "LIN WGT", and some numbers.



20. Remove weight, and press "Enter" twice.



21. Unit will now display "ADD WGT 2".



22. Repeat this process until all of the weights indicated in the chart have been utilized.

23. Press "Enter".



24. Press "Select" until "COMPUTE" appears.

25. Press "Enter".

Unit should now display "COMPUTE....COMPUTED".

26. Press "Zero" button to go back to weigh mode, and check to see if linearity is set.

Linearity Weight Settings

Model	1	2	3	4	5	6	7	8
64	10	20	30	40	50	60		
104	10	20	50	60	70	90	100	
204	10	20	30	50	100	150	200	
203	10	20	30	50	100	150	200	
403	10	20	50	100	200	300	400	
402	10	20	50	100	200	300	400	
603D	50	100	200	300	400	500	600	
602	50	100	200	300	400	500	600	
2102	200	400	600	800	1000	1500	2000	
2101	200	400	600	800	1000	1500	2000	
4102D	200	500	1000	1500	2000	3000	4000	
4102	200	500	1000	1500	2000	3000	4000	
4101	200	500	1000	1500	2000	3000	4000	
6101	500	1000	2000	3000	4000	5000	6000	
8102D	1000	2000	3000	4000	5000	6000	7000	8000
8101	1000	2000	3000	4000	5000	6000	7000	8000
12001	1000	2000	3000	4000	5000	8000	10000	12000

Glossary of Terms

Average Piece Weight	The statistic average weight of a part used in part counting
Auto Zero	Automatically correcting the zero display due to slow drift.
Baud Rate	The transfer rate unit for serial data transmission in transitions per second between the computer and the printer.
Bit	Binary digit.
Calibration	A process where the balance is adjusted to weigh relative to a standard weight.
Capacity	The maximum mass that a balance is capable of weighing accurately. (See "Specifications" section or the max value on the product label for the capacity of your particular model.)
Percent Weighing	Weighing application that uses a preset reference value to equal 100% with the numeric display showing the deviation of the sample weight in percent.
Dynamic Fine Range	A dynamically switching fine resolution (10x) whose effective measurement range is dependent upon the sample weight and the gross weight.
Electronic Balance	An electronic balance senses physical force when weight is placed on it and translates this force into digital form.
Factory Setting	Preset operation parameters set by the manufacturer for normal applications and conditions. These can be changed by the user, but they also can be reset using the Factory mode.
Gross Weight	The total weight on the balance including tare weight.
Leveling	Horizontal aligning of the balance during installation using a level vial.
Linearity	The amount a weight reading may deviate from a straight line between 0 grams and the maximum capacity of the balance.
Parity	A parameter whose values may be odd, even, or none which is used in a method of error checking information in a data transmission.
Permissible Weight	An acceptable standard mass which can be used to calibrate the balance.
Piece Counting	A weighing application for determining the piece count of identical weighing pieces.
Resolution	The smallest fraction of a weight that a balance is able to discern. Example: If weight were added to a balance in increments of .0001 grams, the resolution would be defined as the amount added before the balance reading would change.

Glossary of Terms (continued)

Setup	The process of configuring the balance to operate in a certain way.
Zero Weight	Weight of a container or package that should not be taken into account in the weighing. This value is also referred to as the tare weight.
Zeroing	Compensating for a tare weight by setting the display of the balance at zero with the container or other packaging material on the weighing pan. Often called taring.
Stable Indicator	Symbol that is automatically displayed when the balance reading or weight is not stable. It disappears when the reading becomes stable.
Weigh Pan	The round or square surface upon which the object is placed for weighing.
Weigh Unit	How the weight of the object is expressed.

Gram Conversion Chart

1 Gram =	0.03527396	AV OZ
	0.03215075	TROY OZ
	0.00220462	POUNDS
	0.64301493	PENNY WEIGHT
	15.43235835	GRAIN
	0.77161792	SCRUPLE
	0.56438339	AV DRAM
	0.03527396	AP DRAM
	5.00000000	CARAT
	0.02671725	Tael (HK)
	0.02645547	Tael (S)
	0.02666667	Tael (T)
	0.26666670	MOMME
	0.08573532	TOLA
	0.06596306	BAHT
	0.00980665	NEWTON

Menu Tree

From the weigh screen press the "Mode" key:

(Enter key to go right in chart, "Next" key to go down in chart)

Screen	Screen	Screen	Screen	Screen	
CALIBRATE	EXTERNAL	ADD WEIGHT	CAL OK		
	MANUAL	00000.0000000	Weigh Screen		
UNITS	UNIT1/grams	UNIT2/grams	Cal OK		
	Kilogram	Kilogram	Weigh Screen		
	Milligrams	Etc	Weigh screen		
	Ounce				
	Troy Ounce				
	Pound				
	Grain				
	Pennyweight				
	Carat				
	Tael Hong Kong				
	Tael Singapore				
	Tael Taiwan				
	Momme				
	Dram				
Baht					
Tola					
Custom	00000.000000	UNIT2/grams			
STATS	TURN ON/OFF	Weigh Screen			
	CALC	NUMBER, etc.	LIST		
	LIST	NO STATS or data	EDIT		
	EDIT	NO STATS	CLEAR		
	CLEAR	YES	TURN OFF		
ENVIRO	FILTER	NORMAL	STABIL SPEED		
		HIGH	"		
		VERY HIGH	"		
		VERY LOW	"		
		LOW	"		
	STABIL SPEED	NORMAL	STABIL SENS		
		SLOW	"		
		VERY SLOW	"		
		VERY FAST	"		
		FAST	"		
	STABIL SENS	NORMAL	AUTOZERO		
		FINE	"		
		VERY FINE	"		
		VERY COARSE	"		
COARSE		"			
AUTOZERO	NORMAL	Weigh Screen			
	STRONG	"			
	VERY STRONG	"			
	OFF	"			

Menu Tree (continued)

Screen	Screen	Screen	Screen	Screen
ANIMAL	TURN ON	STABIL SPEED		
	STABIL SPEED	NORMAL	STABIL SENS	
		FAST	"	
		SLOW	"	
	STABIL SENS	NORMAL	Weigh Screen	
		FINE	"	
		VERY FINE	"	
		VERY COARSE	"	
		COARSE	"	
COUNT	PIECE COUNT	ADD 5 PCS	Weigh Screen	
		ADD 10 PCS	"	
		ADD 20 PCS	"	
		ADD 50 PCS	"	
		ADD 100 PCS	"	
		TURN OFF/ON	"	
	AVG PIECE WT	00000.0000000	Weigh Screen	
CHECK WEIGH	LIMITS	LO LIMIT	HI LIMIT	Weigh Screen
	TARGET	TARGET	Weigh Screen	
	TURN OFF	Weigh Screen		
GLP	USER RECALL	USER 1-9	Weigh Screen	
	USER SAVE	USER 1-9	Entry Screen	Weigh Screen
	DATE TIME	MM/DD/YY	"	
		DD/MM/YY	"	
		YY/MM/DD	"	
	SAMPLE TYPE	SMPL TYPE	SEQ Number	
	SEQ NUMBER	0****	USER RECALL	
SERIAL	PRINT MODE	MANUAL	FORMAT	
		STABLE	"	
		INTERVAL	CUSTOM	0000 secs
			5 SEC	FORMAT
			10 SEC	"
			60 SEC	"
	FORMAT	TYPE1-9	BAUD	
		CUSTOM PRINT	DATE/TIME	ON or OFF
			BALANCE ID	"
			SAMPLE TYPE	"
			SEQ NUMBER	"
			LAST CAL	"
			USER	"
			SIGN LINES	"
			(*to Serial Baud)	

Menu Tree (continued)

Screen	Screen	Screen	Screen	Screen
SERIAL	BAUD	9600	PARITY	
		4800	"	
		2400	"	
		1200	"	
		600	"	
		300	"	
		150	"	
		38400	"	
		19200	"	
		BITS/PARITY	8-NONE	ECHO
	7-EVEN		"	
	7-ODD		"	
	ECHO	7-NONE	"	
		OFF	HANDSHAKE	
HANDSHAKE	ON	"		
	XON/XOFF	Weigh Screen		
	NONE	"		
	CTS			
TARE WEIGHTS	SELECT	No Container	STORE-AUTO	
	STORE-AUTO	CONTAINER 1-10		
	STORE-MANUAL	CONTAINER 1-10	(* to store manual)	
	CLEAR	Clear All	SELECT	
		CNTNR 1-10		
BATCH	TURN ON/OFF	Weigh Screen	(* to next setup option)	
SYSTEM	SW VERSION	VX.X	BALANCE ID	
	BALANCE ID	XXX-XXX-XXX	LAST CAL	
	LAST CALL	CAL DATE	SECURITY	
		CAL TIME		
		CAL WEIGHT	(secured area)	
	SECURITY	SUPR USR XXX	Weigh screen	
PASSWORD	XXXXXXXX	Weigh screen		
SPC GRAVITY	WEIGH ABOVE	WEIGH BELOW		
	WEIGH BELOW	Calculates Specific Gravity		
FACTORY	CANCEL	Weigh screen		
	SET DEFAULTS	STANDBY (15 seconds)		
		Then COMPLETE	Weigh screen	

External Transformers

One of the following external transformers is supplied for use with the balance:

Part #	input	output	mains plug type
101627.1	120 VAC ~ 60 hz	15 VDC --- @ 800 mA	North American NEMA 5-15p
101556.1	230 VAC ~ 50/60 hz	15 VDC --- @ 800 mA	Continental European CEE 7/16
101557.1	240 VAC ~ 60 hz	15 VDC --- @ 800 mA	United Kingdom BS 1363

The tolerance for AC input voltage is +/- 10%



Other main plug configurations may be available. Contact your local distributor or Denver Instrument Company.

Accessories

A variety of accessories are available from Denver Instrument to enhance your weighing experience. Contact your local distributor or Denver Instrument for part numbers and pricing.

- Spill Cover
- Lock Down device
- Weigh Below
- Draff Ring (for 4.5 and 6 inch round pan models only)
- Draff Shield (for round pan models only)
- Calibration Weights
- Cable, RJ11 (4) - DB25S IBM-PC
- Cable, RJ11 (4) - DB25P Printer
- Cable, RJ11 (4) - DB9S IBM-AT
- Cable, RJ11 (4) - Blunt
- Printer, thermal 4" print area, parallel and serial ports
- Printer, dot matrix 2" print area, serial only

Cleaning Instructions

- Disconnect electrical power from the balance before cleaning.
- Do not immerse the balance in any liquid.
- Use mild soap or diluted bleach (9 parts water to 1 part bleach) with a soft cloth.
- Do not use chemical solvents for cleaning.
- Before using any cleaning or decontamination methods, except those recommended by the manufacturer, verify with the manufacturer that the proposed method will not damage the equipment.

Maintenance



WARNING

**There are no user serviceable parts within the unit.
Opening the case will void the warranty.**

All repairs must be performed by a factory-trained technician. Contact Denver Instrument Company for your nearest authorized repair location.

Warranty Instructions

1. Please return the prepaid, pre-addressed Purchase Registration Card to Denver Instrument Company promptly upon your purchase of the Denver Instrument product. The return of the card is not a condition precedent to warranty coverage.
2. If you have any questions about a Denver Instrument product, please call toll-free, **1-800-321-1135** (or FAX description of problem to (303) 423-4831) for technical assistance.
3. If it becomes necessary to return your Denver Instrument product for service, you must obtain a **“Return Authorization Number”**. Please pack the product securely in its original approved packing carton or other suitable container and include your Return Authorization Number on the shipping label and as a precaution also a note inside the box. Shipping charges must be fully prepaid.

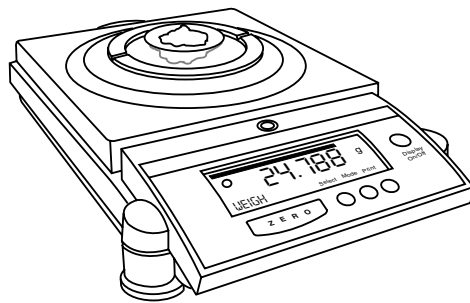
Ship to:

**Denver Instrument Company
6542 Fig Street
Arvada, Colorado 80004**

Purchase Date: _____

Model: _____

Serial Number: _____



 **Denver Instrument Company**

6542 Fig Street • Arvada, Colorado 80004 U.S.A.
1-800-321-1135 • (303) 431-7255 • Fax (303) 423-4831

European Office:

Denver Instrument Company, Ltd.

Denver House, Sovereign Way • Trafalgar Business Park
Downham Market, Norfolk PE38 9SW • England
Tel: (01366) 386242 • Fax: (01366) 386204